

will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings. It is, therefore, contemplated by the appended claims to cover such modifications as incorporate those features which come within the spirit and scope of the invention.

We claim:

1. A method for determining a geolocation of a mobile terminal in a satellite based telecommunications system which supports first and second forward communications links from first and second earth stations through first and second satellites to a common mobile terminal and which supports at least one return communications link from the mobile terminal through the first satellite to the first earth station, said method comprising the steps of:

transmitting first and second communications signals over the first and second forward communications links to the mobile terminal from the first and second earth stations through the first and second satellites, respectively;

obtaining, at the mobile terminal, synchronization differential data based on the first and second communications signals received by the mobile terminal, said synchronization differential data corresponding to a difference in synchronization between the first and second communications signals received by the mobile terminal;

transmitting, from the mobile terminal, the synchronization differential data to the first earth station over the first return link;

determining, at the first earth station, return link synchronization data for the mobile terminal necessary to maintain incoming telecommunications signals received over the return link synchronized with the earth station;

calculating, at the first earth station, at least first and second geoposition lines, along which the mobile terminal is positioned, based on the return link synchronization data and the received synchronization differential data;

determining a geographic point of intersection of the at least first and second geoposition lines; and

outputting the geographic point of intersection as a geolocation of the mobile terminal.

2. A method according to claim 1, wherein the obtaining step further comprises calculating, at the mobile terminal, a differential timing between timings of the first and second communications signals received by the mobile terminal.

3. A method according to claim 1, wherein the obtaining step further comprises calculating, at the mobile terminal, a differential frequency between frequencies of the first and second communications signals received by the mobile terminal.

4. A method according to claim 1, wherein the obtaining step further comprises:

generating a reference timing at the mobile terminal; calculating a first timing difference between the reference timing and the timing of the first communications signal received from the first earth station; and calculating a second timing differential between the reference time and the timing of the second communications signal received from the second earth station; and calculating a differential timing between the first and second timing differences, said differential timing

being included within the synchronization differential data relating to said differential timing.

5. A method according to claim 1, wherein the obtaining step further comprises the steps of:

generating a reference frequency;

calculating a first frequency difference between the reference frequency and a frequency of the first communications signal received from the first earth station;

calculating a second frequency difference between the reference frequency and the frequency of the second communications signal received from the second earth station; and

calculating a differential frequency between the first and second frequency differences, the synchronization differential data transmitted from the mobile terminal to the first earth station relating to said differential frequency.

6. A method according to claim 1, wherein the step of determining a geographic poing of intersection includes the steps of:

obtaining from the synchronization differential data a differential range and differential range rate, the differential range corresponding to a difference in the ranges from the mobile terminal to the first and second satellites, the differential range rate, corresponding to a difference in range rates of the first and second satellites relative to the mobile terminal; and

calculating at least first and second geoposition lines based on the return link synchronization data, the differential range and differential range rate.

7. A method according to claim 1, wherein said communications signal includes a CDMA code identifying the transmitting user terminal.

8. A method according to claim 1, wherein said communications signal includes an orthogonal code uniquely identifying the transmitting user terminal.

9. A method according to claim 1, wherein said step of determining return link synchronization data includes determining a timing offset between a reference timing and a received timing of the incoming communications signal, said return link synchronization data including said timing offset.

10. A method according to claim 1, wherein said step of determining return link synchronization data further comprises determining a frequency offset between a reference frequency and a received frequency of the incoming communications signal, said return link synchronization data including said frequency offset.

11. A method according to claim 1, wherein said step of calculating said first and second geoposition lines includes calculating a range solution line based on said return link synchronization data and synchronization differential data, said range solution line constituting said first geoposition line.

12. A method according to claim 1, wherein said step of calculating said first and second geoposition lines further comprises the step of calculating a Doppler solution line based on said return link synchronization data and synchronization differential data, said Doppler solution line constituting said second geoposition line.

13. A method according to claim 1, further comprising the step of utilizing a beam spot covering the mobile terminal to calculate said points of intersection.